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document HST Time-Series Photometry of the Transiting Planet of HD 2094581 Timothy M. Brown2, David Charbonneau3,2, Ronald L. Gilliland4, Robert W. Noyes3, Adam Burrows5 1Based on observations with the NASA/ESA *Hubble Space Telescope*, obtained at the Space Telescope Science Institute, which is operated by the Association of Universities for Research in Astronomy, Inc. under NASA contract No. NAS5-26555. 2High Altitude Observatory/National Center for Atmospheric Research, 3450 Mitchell Lane, Boulder, CO 80307. The National Center for Atmospheric Research is sponsored by the National Science Foundation. timbrown@hao.ucar.edu 3Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA 02138 dcharbonneau@cfa.harvard.edu rnoyes@cfa.harvard.edu 4Space Telescope Science Institute, 3700 San Martin Dr., Baltimore, MD 21218 gillil@stsci.edu 5Department of Astronomy, University of Arizona, 933 North Cherry Avenue, Tucson, AZ 85721 aburrows@as.arizona.edu

abstract We have observed 4 transits of the planet of HD 209458 using the STIS spectrograph on HST. Summing the recorded counts over wavelength between 582 nm and 638 nm yields a photometric time series with 80 s time sampling and relative precision of about 1.1×10^{-4} per sample. The folded light curve can be fit within observational errors using a model consisting of an opaque circular planet transiting a limb-darkened stellar disk. In this way we estimate the planetary radius $R_p = 1.347 \pm 0.060\ R_{\rm Jup}$, the orbital inclination $i = 86.68^\circ \pm 0.14^\circ$, the stellar radius $R_* = 1.146 \pm 0.050\ R_\odot$, and one parameter describing the stellar limb darkening. Our estimated radius is smaller than those from earlier studies, but is consistent within measurement errors, and is also consistent with theoretical estimates of the radii of irradiated Jupiter-like planets. Satellites or rings orbiting the planet would, if large enough, be apparent from distortions of the light curve or from irregularities in the transit timings. We find no evidence for either satellites or rings, with upper limits on satellite radius and mass of 1.2 $R_\oplus$ and 3 $M_\oplus$, respectively. Opaque rings, if present, must be smaller than 1.8 planetary radii in radial extent. The high level of photometric precision attained in this experiment confirms the feasibility of photometric detection of Earth-sized planets circling Sun-like stars.